

U.S.S.N. 10,656,986

Remarks

Thorough examination by the Examiner is noted and appreciated.

The claims have been amended to clarify Applicants disclosed and claimed invention.

Support for the amendments is found in the original claims and the Specification.

No new matter has been added.

PREMATURE FINALITY

Applicants respectfully request withdrawal of Finality since the newly applied art was not necessitated by Applicants amendments, but rather, the newly cited art arguably represents more pertinent art to Applicants disclosed invention. Applicants respectfully note this is the second time different art has been applied in rejection. Applicants respectfully point out that Applicants are entitled to a complete search and examination of their invention including reasonably anticipated limitations that

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may be claimed to avoid multiple searches resulting in piecemeal examination. For example, Applicants respectfully refer Examiner to the following portions of the MPEP:

MPEP 706.07

Before final rejection is in order a clear issue should be developed between the examiner and applicant. To bring the prosecution to as speedy conclusion as possible and at the same time to deal justly by both the applicant and the public, the invention as disclosed and claimed should be thoroughly searched in the first action and the references fully applied; and in reply to this action the applicant should amend with a view to avoiding all the grounds of rejection and objection. Switching from one subject matter to another in the claims presented by applicant in successive amendments, or from one set of references to another by the examiner in rejecting in successive actions claims of substantially the same subject matter, will alike tend to defeat attaining the goal of reaching a clearly defined issue for an early termination, i.e., either an allowance of the application or a final rejection.

MPEP 707.07(g) Piecemeal Examination

Piecemeal examination should be avoided as much as possible. The examiner ordinarily should reject each claim on all valid grounds available, avoiding, however, undue multiplication of references. (See MPEP § 904.03.)

MPEP 904.03

It is normally not enough that references be selected to meet only the terms of the claims alone, especially if only broad claims are presented;

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but the search should, insofar as possible, also cover all subject matter which the examiner reasonably anticipates might be incorporated into applicant's amendment. Applicants can facilitate a complete search by including, at the time of filing, claims varying from the broadest to which they believe they are entitled to the most detailed that they would be willing to accept.

MPEP 706.07(A)

A second or any subsequent action on the merits in any application or patent involved in reexamination proceedings should not be made final if it includes a rejection, on prior art not of record, of any claim amended to include limitations which should reasonably have been expected to be claimed. See MPEP § 904 *et seq.*

Applicants therefore respectfully request withdrawal of finality of rejection to either allow entry of the present amendments to place the application in condition for allowance or for an opportunity to meaningfully amend Applicants claims to define over the newly cited art.

Claim Rejections under 35 USC 102

1. Claims 1-10, 12-18, and 20-21 stand rejected under 35 USC Section 102(e) as being anticipated by Subramanian et al. (US 6,803,178).

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Subramanian et al. disclose a method for **exposing the same feature pattern** but with a **different density** (pitch) (i.e., **dense vs. isolated**) between the same feature pattern under different illumination conditions and using different masks (see Abstract; Figures 4A, 4B, Figures 5A, 5B, Figures 6 and Figures 7). The invention of Subramanian et al. is directed at overcoming the problem **patterning errors** (e.g., vias patterned a different size and location) caused by a smaller process window (overlapping regions of optimal exposure dose and defocus) for small feature patterns having different areas of density (see col 1, lines 39-63; col 2, line 65-col 3, line 11).

The method of Subramanian et al. teaches a method for making **a plurality of features (same feature pattern) having dense regions and isolated regions (defined as having a different pitch or spacing between features)** (see col 3, lines 11-33). Thus in Figures 4A and 4B (and Figures 5A and 5B using negative resist), Subramanian et al. shows the formation of vias (same feature/pattern) in a dense region and an isolated region (see col 4, lines 18-20) preferably using different defocus conditions (col 4, lines 44-48).

Subramanian et al. also teaches that the same method may be used to pattern a **plurality of features (the same**

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feature/pattern) in a conductive layer such as gate electrodes, emitter regions of a bipolar transistor. Thus in Figure 6, Subramanian et al. shows the patterning of metal electrodes by **separately exposing dense and then isolated portions of the photoresist with the same feature pattern**. Figure 7 shows a completed device with different features (vias, metallization lines) formed by the method of separately exposing under different photoexposure conditions the dense regions and the isolated regions **for the same feature/pattern**.

Thus, Subramanian et al. fails to disclose several aspects of Applicants disclosed and claimed invention including those elements in **bold type**.

"A method for exposing a blanket photoresist layer to achieve optimal photoexposure conditions to **produce different non-overlapping die patterns**"

or

"**exposing within a single die region** within the photoresist layer a minimum of **two non-overlapping die sub-patterns** while

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employing a minimum of two masks, each of said masks associated with one of said **non-overlapping die sub-patterns**, each of said **non-overlapping die patterns comprising a different pattern complexity** subjected to a different photoexposure condition."

Subramanian et al. nowhere discuss or suggest **die sub-patterns having a different pattern complexity**. Rather, as noted above, the invention of Subramanian et al. is directed to patterning dense versus isolated regions on the photoresist layer with the same pattern (feature).

In addition, with respect to claim 6, Subramanian et al. fail to disclose:

"exposing within a single die region within the photoresist layer a minimum of two non-overlapping die sub-patterns while employing a minimum of two masks and two exposure conditions, each of said masks associated with one of said non-overlapping die sub-patterns, each of said non-overlapping die patterns **comprising a different pattern density and a different pattern complexity** subjected to a different photoexposure condition."

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In addition, with respect to claims 6 and 14, Subramanian et al. fail to disclose:

"exposing within a single die region within the photoresist layer a minimum of two non-overlapping die sub-patterns while employing a minimum of two masks, to form an exposed photoresist layer, each of said masks associated with one of said non-overlapping die sub-patterns, each of said non-overlapping die patterns comprising a **different pattern density and a different pattern complexity** subjected to a different exposure condition;"

Examiner is required to interpret the claims by giving the terms thereof the broadest reasonable interpretation **in their ordinary usage as they would be understood by one of ordinary skill in the art in light of the written specification, including drawings**, unless another meaning is intended by appellants as established in the written specification, and without reading into the claims any limitation or particular embodiment disclosed in the specification. See e.g., *In re Morris*, 127 F.3d. 1048, 1054-55, 44 USPQ2d 1023, 1027 (Fed. Cir 1997); *In re Zeltz* (893 F.2d 319, 321-22, 13 USPQ2d 1320, 1322 (Fed. Cir. 1989)).

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"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

"The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

Claim Rejections under 35 USC 103

2. Claims 11 stands rejected under 35 USC Section 103(a) as being unpatentable over Subramanian et al., above, in view of Lai et al.

Applicants reiterate the comments made above with respect to Lai et al. (US 6,187,486).

Applicants reiterate the comments made above with respect to Subramanian et al.

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The fact that Lai et al. generally teach that the exposure energy, the exposure time, and the depth of focus affect the line width of a pattern does not further help Examiner in producing Applicants invention.

"Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure." *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

3. Claims 1 and 3 stand rejected under 35 USC Section 103(a) as being unpatentable over by Aoki et al. (US 5,298,761) in view of Shibuya et al. (US 5,851,707).

Aoki et al. disclose a process for **eliminating stitching errors (misalignment errors)** between adjacent and abutting photoexposed sub-patterns formed by a different reticle to create a composite patterned area (see Abstract; Figure 1A; col 1, lines 35-59; col 2, lines 5-16). In the method of Aoki et al., an

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amount of **deviation of an exposure position** with respect to an abutting pattern area is first determined, the deviation is then compensated, and the reticle (original image) is then aligned pattern-by-pattern (see e.g., see col 2, lines 17-67; claim 1); Aoki et al. disclose that reticles (original images) may contain **the same or a different pattern** (col 2, lines 45-48). Aoki et al. teach that when image composition is effected **using only a single pattern**, it is only necessary to determine offset values at two abutting portions in one stitching direction (col 22, lines 58-69).

Nowhere do Aoki et al. disclose using different photoexposure conditions with respect to different non-overlapping die patterns.

Shibuya et al. teach **achieving the same photoexposure conditions** (equivalent intensity of illumination light flux) for singly exposed **photoresist areas** using one mask and multiple exposure photoresist areas using several masks (see Abstract).

Shibuya et al. teach that by altering the light intensity distribution in multiple exposures of the same photoresist area, fine patterns exceeding the resolution limit of the projecting

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optical system may be produced (col 1, lines 25-32). Shibuya et al. overcome the problem of different linewidths being produced in a multiple exposure area of versus a single exposure area of the photoresist due to different average light intensity exposure of the different areas (col 1, lines 33-40).

On the other hand Shibuya et al. teach several embodiments whereby either the first mask used for the single exposure or the multiple masks used for the multiple exposure area **is modified** for **multiple overlapping exposures** of the **same area** on the photoresist (see e.g., col 6 lines 1-22).

Even assuming arguendo, a proper motivation for combining the teachings of Aoki et al. and Shibuya et al., the fact that Shibuya et al. further teach using a minimum of two different photoexposure conditions in a process that operates by a different principle of operation than both Aoki et al. and Applicants disclosed and claimed invention, such combination does not produce Applicants disclosed and claimed invention.

Aoki et al. disclose a process for eliminating stitching errors (misalignment errors) between abutting photoexposed sub-

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patterns formed by a different reticle to create a composite patterned photoresist area. Shibuya et al., teach multiple exposures **using multiple overlapping mask patterns of a single photoresist area** to equalize the light flux with respect to a single exposure using a single mask on a different photoresist area.

The combined teachings of Aoki et al. and Shibuya et al. do not disclose or suggest:

"exposing within a single die region within the photoresist layer a minimum of two non-overlapping die sub-patterns while employing a minimum of two masks, each of said masks associated with one of said non-overlapping die sub-patterns, each of said non-overlapping die patterns comprising a different pattern complexity subjected to a different photoexposure condition".

Aoki et al. do not discuss different photoexposure conditions, while Shibuya et al. do not teach non-overlapping die patterns **subjected to a different photoexposure condition**; but rather, Shibuya et al. teach **different areas on the photoresist subjected to the same photoexposure conditions** (e.g., same

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average light intensity flux).

"Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure." *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Examiner argues that Shibuya et al. is only relied on for the teachings in the background section "that simply indicate that there are advantages to exposing different subpatterns in a resist layer to different exposure conditions". Rather, however, Shibuya et al. generally discuss in the background that multiple exposure technique to achieve sub-resolution patterns are known (col 1, lines 8-41) and nowhere discuss different die sub-patterns or die sub-patterns having a different complexity or density.

Conclusion

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The cited references, either individually or in combination, fail to produce Applicants disclosed and claimed invention and are therefore insufficient to make out a *prima facie* case of anticipation or obviousness.

Moreover, none of the cited references either individually or in combination recognize the problem or provide a solution to the problem that that Applicants have recognized and solved by their disclosed and claimed invention:

"A method for exposing a blanket photoresist layer to achieve optimal photoexposure conditions to produce different non-overlapping die patterns"

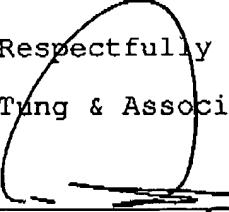
Based on the foregoing, Applicants respectfully submit that Applicants Claims are now in condition for allowance. Such favorable action by the Examiner at an early date is respectfully solicited.

In the event that the present invention as claimed is not in a condition for allowance for any other reasons, the Examiner is respectfully invited to call the Applicants' representative at his Bloomfield Hills, Michigan office at (248) 540-4040 such that

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necessary action may be taken to place the application in a condition for allowance.

Respectfully submitted,
Tung & Associates


Randy W. Tung
Reg. No. 31,311
Telephone: (248) 540-4040